

CLAIMS

1. A pharmaceutical composition, comprising starch granules containing at least one fusion polypeptide containing :

– in the N-terminal position :

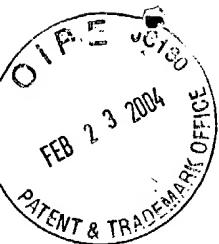
* the peptide sequence SEQ ID NO : 3 corresponding to the granule bound starch synthase GBSSI of *Chlamydomonas reinhardtii* in the form of pre-protein of 708 amino acids, or the sequence SEQ ID NO : 5 corresponding to the GBSSI of *Chlamydomonas reinhardtii* in the form of mature protein of 651 amino acids, said sequences being encoded by nucleotide sequences SEQ ID NO : 2, and 4 respectively, or by a nucleotide sequence derived by degeneration of the genetic code of the aforementioned nucleotide sequences, and coding for the aforementioned pre-GBSSI or GBSSI of *Chlamydomonas reinhardtii*,

* or a fragment of the GBSSI of *Chlamydomonas reinhardtii* represented by SEQ ID NO : 3, in which the amino acid of the amino terminal end corresponds to that located in one of the positions 1 to 58 of SEQ ID NO : 3, and in which the amino acid of the carboxy terminal end corresponds to that located in one of the positions 495 to 708 of SEQ ID NO : 3,

– and, in the C-terminal position, a peptide or polypeptide of interest, the C-terminal part of the amino acid sequence of the GBSSI or fragment thereof mentioned above, thus being bound to the N-terminal part of the peptide sequence of interest, the said fusion polypeptide being encoded by a recombinant nucleotide sequence containing in the 5'→3' direction, a nucleotide sequence coding for said *Chlamydomonas reinhardtii* GBSSI or fragment thereof, the said nucleotide sequence coding for this enzyme being positioned upstream of a nucleotide sequence coding for the peptide or polypeptide of interest, the peptide of interest in the said fusion polypeptides possessing a defined therapeutic effect.

2. A pharmaceutical composition according to claim 1 characterized in that fragment of the GBSSI of *Chlamydomonas reinhardtii* represented by SEQ ID NO : 3, is :

. the sequence SEQ ID NO : 7 corresponding to a fragment of 438 amino acids of the peptide sequence of the GBSSI of *Chlamydomonas reinhardtii*,



the sequence SEQ ID NO : 9 corresponding to a fragment of 531 amino acids of the peptide sequence of the GBSSI of *Chlamydomonas reinhardtii*,

said sequences being encoded by nucleotide sequences SEQ ID NO : 6 and 8 respectively , or by a nucleotide sequence derived by degeneration of the genetic code of the aforementioned nucleotide sequences, and coding for the aforementioned GBSSI fragments of *Chlamydomonas reinhardtii*.

3. A pharmaceutical composition according to claim 1 characterized in that the peptide or polypeptide of interest is selected from:

– those encoding biologically active peptides, especially peptides of therapeutic interest or that can be used in the agricultural and food industry, or

– those encoding enzymes that are able to transform starch, such as enzymes that interact with α -glucans including various hydrolases, phosphorylases, α -1,4 glucanotransferases, branching enzymes, amylases, and especially heat-resistant hydrolases obtained from extremophiles such as archaebacteria that are active at temperatures above 40°C.

4. A pharmaceutical composition according to claim 1 characterized in that the fusion polypeptide contains a cleavage site positioned between the starch synthase, and the polypeptide of interest.

5. A pharmaceutical composition according to claim 1, wherein the diameter of the starch granules being between about 0.1 μ m and several tens of μ m, and the proportion by weight of the fusion polypeptides in these granules being between about 0.1% and 1%.

6. A pharmaceutical composition comprising one or more fusion polypeptides containing :

– in the N-terminal position :

* the peptide sequence SEQ ID NO : 3 corresponding to the granule bound starch synthase GBSSI of *Chlamydomonas reinhardtii* in the form of pre-protein of 708 amino acids, or the sequence SEQ ID NO : 5 corresponding to the GBSSI of *Chlamydomonas reinhardtii* in the form of mature protein of 651 amino acids, said sequences being encoded by nucleotide sequences SEQ ID NO : 2, and 4 respectively,

or by a nucleotide sequence derived by degeneration of the genetic code of the aforementioned nucleotide sequences, and coding for the aforementioned pre-GBSSI or GBSSI of *Chlamydomonas reinhardtii*,

* or a fragment of the GBSSI of *Chlamydomonas reinhardtii* represented by SEQ ID NO : 3, in which the amino acid of the amino terminal end corresponds to that located in one of the positions 1 to 58 of SEQ ID NO : 3, and in which the amino acid of the carboxy terminal end corresponds to that located in one of the positions 495 to 708 of SEQ ID NO : 3,

– and, in the C-terminal position, a peptide or polypeptide of interest, the C-terminal part of the amino acid sequence of the GBSSI or fragment thereof mentioned above, thus being bound to the N-terminal part of the peptide sequence of interest, the said fusion polypeptide being encoded by a recombinant nucleotide sequence containing in the 5'→3' direction, a nucleotide sequence coding for said *Chlamydomonas reinhardtii* GBSSI or fragment thereof, the said nucleotide sequence coding for this enzyme being positioned upstream of a nucleotide sequence coding for the peptide or polypeptide of interest, the peptide of interest in the said fusion polypeptides possessing a defined therapeutic effect.

7. A pharmaceutical composition according to claim 6 characterized in that fragment of the GBSSI of *Chlamydomonas reinhardtii* represented by SEQ ID NO : 3, is :

. the sequence SEQ ID NO : 7 corresponding to a fragment of 438 amino acids of the peptide sequence of the GBSSI of *Chlamydomonas reinhardtii*,

. the sequence SEQ ID NO : 9 corresponding to a fragment of 531 amino acids of the peptide sequence of the GBSSI of *Chlamydomonas reinhardtii*,

said sequences being encoded by nucleotide sequences SEQ ID NO : 6 and 8 respectively , or by a nucleotide sequence derived by degeneration of the genetic code of the aforementioned nucleotide sequences, and coding for the aforementioned GBSSI fragments of *Chlamydomonas reinhardtii*.

8. A pharmaceutical composition according to claim 6 characterized in that the peptide or polypeptide of interest is selected from:

– those encoding biologically active peptides, especially peptides of therapeutic interest or that can be used in the agricultural and food industry, or

— those encoding enzymes that are able to transform starch, such as enzymes that interact with α -glucans including various hydrolases, phosphorylases, α -1,4 glucanotransferases, branching enzymes, amylases, and especially heat-resistant hydrolases obtained from extremophiles such as archaebacteria that are active at temperatures above 40°C.

9. A pharmaceutical composition according to claim 6 characterized in that the fusion polypeptide contains a cleavage site positioned between the starch synthase, and the polypeptide of interest.